2. SITE DESCRIPTION AND BACKGROUND

2.1 Site Background

The INEEL is a U.S. government-owned facility managed by the DOE. The eastern boundary of the INEEL is located 52 km (32 mi) west of Idaho Falls, Idaho. The INEEL site occupies approximately 2,305 km^2 (890 mi^2) of the northwestern portion of the Eastern Snake River Plain in southeast Idaho. The INTEC is located in the south-central portion of the INEEL as shown in Figure 1-1. The INTEC was formerly known as the Idaho Chemical Processing Plant (ICPP).

From 1952 until 1992, the mission of the ICPP was to store spent nuclear fuel (SNF) from test and research reactors and defense projects, to reprocess the SNF to recover the usable uranium, to perform chemical technology research, and to develop improved fuel processing methods. In 1992, the DOE announced that fuel reprocessing at the ICPP would be phased out. To more closely reflect its current mission, in 1998 the ICPP was designated the Idaho Nuclear Technology and Engineering Center. The current mission of the INTEC is to manage and store spent nuclear fuel, to treat and store high-level waste generated during past spent nuclear fuel reprocessing and low-level waste generated primarily from decontamination, and to manage ongoing and future operations and activities.

Because of different types of reprocessing operations, several types of radioactive liquid waste were produced at the ICPP. Although fuel processing has been phased out, liquid waste generated from the reprocessing activities continues to be stored at the INTEC in the Tank Farm and processed, using a calcining process to convert liquid to a more stable granular form. The Tank Farm consists of 22 underground stainless steel tanks with volume capacities ranging from 69,644 to 1,135,500 L (18,400 to 300,000 gal). After processing, calcined solids are stored in stainless steel bins known as the Calcined Solids Storage Facilities (CSSF). Disposition of liquid waste in the Tank Farm and calcined solids will be addressed in the Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement (HLW & FD EIS) (DOE-ID 1999a).

Releases of radioactive and hazardous waste to the environment have occurred at the INTEC over the past decades as a result of accidental releases from spills and leaks in the Tank Farm (Figure 2-1). In 1989, the INEEL was added to the EPA National Priorities List (NPL) (54 FR 48184) and became subject to CERCLA. Contaminated sites at the INTEC contributed to listing the INEEL on the NPL. When the FFA/CO was negotiated, the INEEL was divided into 10 WAGs, and the INTEC was designated WAG 3.

A total of 95 WAG 3 release sites were identified at the INTEC. Of these sites, 92 were evaluated in the OU 3-13 Comprehensive Remedial Investigation/Baseline Risk Assessment (RI/BRA) (DOE-ID 1997), completed in 1997, and 40 were determined to require remedial action. The OU 3-14 RI/FS comprises all Tank Farm soil sites consolidated within CPP-96 in the OU 3-13 ROD (DOE-ID 1999b). Site CPP-96 incorporates all soil and release sites within the Tank Farm boundary as described in the OU 3-14 Tank Farm FSP. The release sites contained within Site CPP-96 include sites CPP-15, CPP-16, CPP-20, CPP-24, CPP-25, CPP-26, CPP-27, CPP-28, CPP-30, CPP-31, CPP-32, CPP-33 (E and W), CPP-58 (E and W), CPP-79, and CPP-96. The locations of these sites are shown in Figure 1-2. The soils at these sites are known to have contamination originating from spills and pipeline leaks of radioactive liquids from liquid transfer operations. No evidence has been found to indicate that any of the tanks themselves have leaked. Only limited investigations have been conducted at the Tank Farm sites because many of the spill areas occurred in operational and radioactive areas. The OU 3-13 baseline risk assessment (BRA) indicated that the sites (evaluated as Group 1) pose an unacceptable risk to current and future site workers or residents. However, the current information about the nature and extent of contamination in the Tank Farm is inadequate to support selection of a final remedy for the contaminated areas.

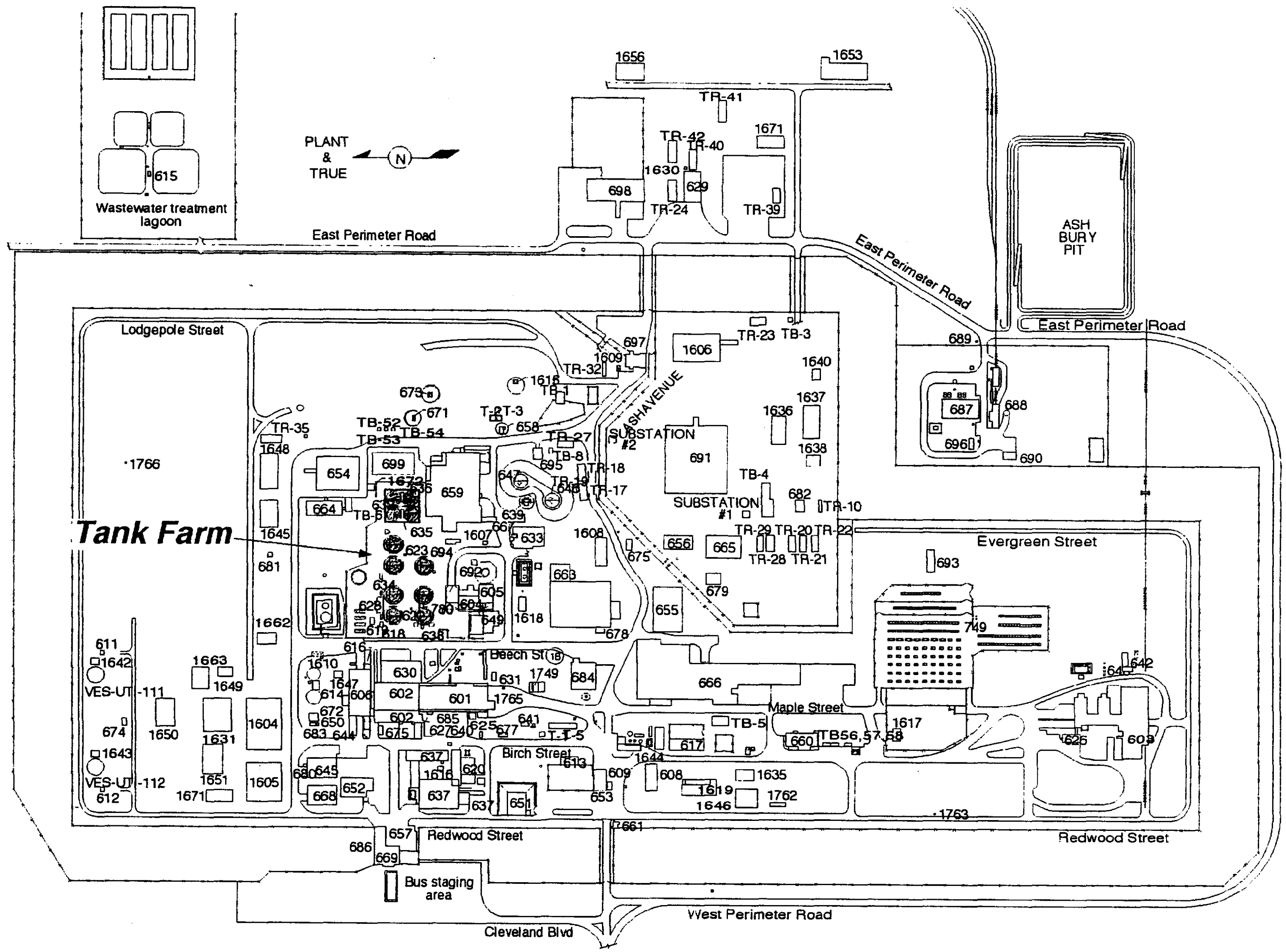

Figure 2-1. Physical layout of the Idaho Nuclear Technology and Engineering Center showing the Tank Farm.

As outlined in the WAG 3 Proposed Plan (DOE-ID 1998), an interim action for the Tank Farm Group 1 is proposed to reduce worker exposures to contaminated soil, and reduce surface water run-on and run-off at the release sites. The individual Tank Farm release site descriptions are found in Section 2.2.

2.2 Source, Nature, and Extent of Contamination

A brief description of each of the release sites to be sampled is given below. A more complete description of INTEC and the Tank Farm release sites is found in the main body of the OU 3-14 RI/FS work plan (DOE-ID 2000a). The information presented below is based on supervisor's daily logs, occurrence reports, and published reports. This information was compiled in Track 1 and Track 2 reports, as well as the OU 3-13 RI/FS.

Although the following sites were evaluated during previous CERCLA investigations (Track 1 and Track 2 investigations, OU 3-13 RI/FS), they are being revisited in the OU 3-14 RI/FS, as discussed herein.

2.2.1 Site CPP-15

Site CPP-15 is the former location of a solvent burner building, CPP-629, which began operation in the late 1950s and was dismantled in 1983. The spent solvent burned in the building came from the process used to separate uranium from fission products in the uranyl nitrate solution produced in the fuel dissolution process. The solvent was composed of a tributyl phosphate and purified kerosene solution. During operations, the burner flue routinely leaked combustion products, resulting in contamination in the area east of Building CPP-629. A 1977 analysis of soot taken from the flue detected Am-241, Pu-238, Pu-239, Cs-137, Nb-95, Ru-106, and Sb-125.

On March 28, 1974, during maintenance of the solvent burner, liquid was found on the ground inside and outside CPP-629. Spent solvent was determined to have leaked from the ground surface flange directly above the solvent feed tank. The quantity of spilled liquid is unknown. It was reported that beta/gamma radiation readings as high as 3 R/hr were detected in the contaminated soil outside the building, which was removed and placed in drums. Uncontaminated soil was used to backfill the excavation.

The demolition of the building in 1983 included removal of the furnace/burner unit, furnace duct, control shed, piping, valves, and controls within the shed, piping penetrating the shed, the solvent feed tank (LE-102), and contaminated soil in the area. Interviews with personnel involved in the demolition indicated that soil excavation exceeded 10 ft (3 m)bgs and was very thorough. No sampling was performed to confirm that all contamination had been removed. Site CPP-15 was originally included in OU 3-08, which underwent a Track 2 investigation in 1993 (WINCO 1993b). On the basis of the information about the demolition and removal of contaminated soil from the site, no sampling and analysis was performed as part of the Track 2 investigation, and CPP-15 was recommended for a no further action determination.

In September 1995, construction personnel encountered elevated radiological readings while excavating soil in the western portion of the CPP-15 site (see Figure 1-2). The excavation was in support of the installation of an electrical duct bank and transformer pad. The contaminated soil was encountered at a depth of 0.6 m (2 ft). Beneath the contaminated soil was a concrete footing with a hotspot reading of 1.5 R/hour. The footing was a remnant of the old stack pre-preheater. Six soil samples were collected in the area of the contaminated footing. The samples were collected from the following locations:

- A stockpile of excavated soil in a dump truck (Sample CPP-15-1)
- Soil about 0.46 m (1.5 ft) away from the footing, 2 ft bgs (Sample CPP-15-2)
- Soil directly below the footing (Samples CPP-15-3 and CPP-15-5)
- Soil 1.2 m (4 ft) below the footing (Sample CPP-15-4)
- Soil 2.6 m (8.5 ft) below the footing (Sample CPP-15-6).

The results of the analyses indicate that the highest levels of radionuclide contamination were present in the samples collected 2.6 m (8.5 ft) below the contaminated footing and 3.2 m (10.5 ft) bgs. This would suggest that not all of the contaminated soil was removed during the 1983 demolition activities and is consistent with the report that the excavation extended only to 10 ft (3 m) bgs. Cesium-137 was the only radionuclide detected in the four shallow-soil samples during an analysis for gamma-emitting radionuclides. The detected concentrations ranged from 2,350 ± 120 pCi/g to 43,300 ± 1,800 pCi/g. In addition to gamma spectroscopy analysis, the sample from 3.2 m (10.5 ft) bgs was analyzed for a suite of other radionuclides including I-129, Np-237, total strontium, Tc-99, and plutonium and uranium isotopes. The Cs-137 activity in the sample was 586,000 ± 170,000 pCi/g. Other radionuclides detected in the sample were Am-241 at 538 ± 35 pCi/g, Eu-154 at 243 ± 24 pCi/g, Np-237 at 0.63 pCi/g, Pu-238 at 4,570 ± 320 pCi/g, Pu-239/240 at 825 ± 63 pCi/g, Tc-99 at 36.7 pCi/g, and U-235 at 0.0203 pCi/g.

All of the soil samples were analyzed for metals, cyanide, sodium, potassium, semivolatile organic compounds (SVOCs), percent solids, and volatile organic compounds (VOCs) by Method SW-846 or Contract Laboratory Program methods. Zirconium was detected in all six samples at concentrations ranging from 5.13 to 13.97 mg/kg. Thallium was detected in the sample from 3.2 m (10.5 ft) bgs at 4.85 mg/kg. The reported results for all other metals in the samples were consistent with background soil concentrations of the metals on the INEEL. Methylene chloride was detected in all of the samples at very low concentrations (<0.01 mg/kg) and also was detected in the method blanks. Trichloroethene was detected in the sample of soil from the dump truck, at an estimated concentration of 4.6 μg/kg.

The detected compounds include tri-n-butyl phosphate, acenaphthene, phenanthrene, anthracene, fluoranthene, benzo (k) fluoranthene, and benzo (b) fluoranthene. The analysis indicated that the compounds were present at concentrations below the sample quantitation limit. Also detected in many of the samples were 3-nitroaniline, azobenzene, 2-methylphenol, bis(2-chlorethyl)ether, 2,6-dinitrotoluene, and numerous tentatively identified compounds. A number of other compounds including naphthalene, 2-methylnaphthalene, 2-chloronaphthalene, acenaphthylene, dimethylphthalate, dibenzofuran, fluorene, diethylphthalate, carbazole, di-n-butylphthalate, bis(2-ethylhexyl)phthalate, butylbenzylphthalate and di-n-octylphthalate were reported present in both the samples and the reagent blank.

The past sampling and analysis performed gives some information on the types of contaminants present at the site, but is incomplete. Residual contamination may still exist in the soils above 10 ft (3 m), based on the sampling and analysis results. The soil samples were collected from the western portion of the site; however, the eastern portion of CPP-15 remains uncharacterized. No sampling and analysis data are available below 10.5 ft (3.2 m); therefore, the vertical extent of contamination remains undefined, and the site will be examined further.

2.2.2 Site CPP-16

Site CPP-16 is the site of a leak that occurred on January 16, 1976. The leak occurred through an open-bottom valve box during a routine transfer of low-level radioactive water from WM-181 to the Process Equipment Waste Tank WL-102. Wastewater steam melted the Teflon flange gasket during the transfer, allowing the leak to occur. The plastic liner to the valve box also melted. The leak of low-level contaminated service wastewater drained out the bottom of the valve box into the soil to 3 ft (0.9 m) beneath the valve box, which was at a depth of 5 ft 8 in. (1.77 m) (WINCO 1976, 1991). This valve box was replaced on January 19, 1976, with a concrete bottom valve box with a stainless steel liner that extends 6 ft 9 in. (2.06 m) bgs. The volume in WM-181 before the attempted transfer was 89,200 gal (337,658 L) and after the leak was 85,700 gal (324,409 L) (Ward 2000); therefore, approximately 3,500 gal (13,249 L) leaked onto the soil.

There is no knowledge of what was encountered during the replacement of the valve box, how much soil was removed, or how much remains. Contaminants estimated to be present include Cs-137, Sr-90, uranium and plutonium isotopes, and some inorganic constituents. Radionuclide levels were surveyed at 1.2 Ci beta and gamma (WINCO 1991). The amount of soil contaminated during the spill is estimated at 25 ft^3 (0.71 m^3) (WINCO 1991). This site was recommended in the OU 3-07 Track 2 summary report (WINCO 1993a) as a no further action site, but site CPP-16 is being revisited in the OU 3-14 RI/FS as part of the Tank Farm soil investigation.

2.2.3 Site CPP-20

Site CPP-20 is located north of building CPP-604 (see Figure 1-2) where radioactive liquid waste from INEEL facilities was transported and unloaded via transfer hoses to an underground storage tank. The facility was used for this purpose until 1978. The waste was destined for treatment in the process equipment waste (PEW) evaporator. Small spills would occasionally occur as waste was being unloaded through holes in the pressurized transfer line, resulting in soil contamination. The spills reportedly were cleaned up as they occurred, but no records exist documenting the types, quantities, and locations of the spills or verifying the effectiveness of cleanup activities.

The entire area of site CPP-20 was excavated down to 12.2 m (40 ft) in 1982 as part of Phase I of the Fuel Processing Facility Upgrade Project. Personnel involved in the project indicate that the bottom 10 ft (3 m) of the excavation was backfilled with soil contaminated with radionuclides at activities of 5 mR/hour or less. The source of the contaminated soil is unknown, but it is likely that it was from within the Tank Farm. The remaining 30 ft (9 m) of the excavation was reportedly backfilled with clean (i.e., not radiologically contaminated) soil. Portions of the area were excavated a second time as part of the Fuel Processing Facility Upgrade Project in 1983 to 1984. Reportedly, the eastern portion of CPP-20 was excavated to a depth of 12.2 m (40 ft). At the location of valve box C-30, contaminated soil was encountered and removed. The bottom 10 ft (3 m) of the excavation was reportedly backfilled with radiologically contaminated soil with activities of 3 mR/hour or less, and the remainder of the excavation was backfilled with clean soil from the Central Facilities Area. It was common practice to use backfill containing trace quantities of radioactivity during the 1980s.

No sampling and analysis of the contaminated backfill, reported between 30 and 40 ft (9 and 12 m) bgs, has been performed. The detected arsenic concentration, 5.9 mg/kg, was just slightly above the estimated background concentration of arsenic in INEEL surface soil (5.8 mg/kg). Strontium-90 and Cs-137 were detected at 330 ± 3 pCi/g and 114 ± 1 pCi/g, respectively.

Site CPP-20 was originally included in OU 3-07, which underwent a Track 2 investigation in 1992 (WINCO 1993a). On the basis of the information indicating that contaminated soil had been removed from the site during the Fuel Processing Facility Upgrade Project, the site was recommended for no further action, contingent on the evaluation of the contaminated backfill as part of the OU 3-13 RI/FS.

2.2.4 Site CPP-24

Site CPP-24 is the result of a 1-gal bucket spill of radioactively contaminated solution from WM-180 in 1954. While the exact location of the spill was not documented, the spill occurred in the vicinity of a WM-180 tank riser and covered a 3 × 6-ft area. Levels of radioactivity were surveyed at approximately 400 mR/hour. The spill would have contained mercuric nitrate, nitric acid, and radionuclides. It was reported in a Radioactivity Incident Report that the spill area was decontaminated. This site was recommended in a Track 2 investigation as a No Further Action site on the basis that any residual contamination would be addressed during OU 3-13 RI/FS. CPP-24 is being revisited in OU 3-14 RI/FS as part of the Tank Farm soil investigation.

2.2.5 Site CPP-25

Site CPP-25 is located in the same general area as CPP-20 and overlaps CPP-20 on the eastern edge (see Figure 1-2). It is the location of a ruptured transfer line that was being used to transfer liquid waste from a tank, WC-119, to another tank, WL-102. The line released an unknown quantity of liquid waste adjacent to the north side of Building CPP-604. The release occurred in August 1960. Reportedly, radiation readings in the contaminated soil ranged from 2 to 4 R/hour. Approximately 7 m^3 (9 yd^3) of soil was removed after the spill, and the side of the building was washed to remove contamination.

As described for CPP-20, the area where CPP-25 is located was excavated during the 1981 and 1983–1884 Fuel Processing Facility Upgrade Project. Site CPP-25 was also originally included in OU 3-07 that underwent a Track 2 investigation in 1992 (WINCO 1993a). On the basis of the information indicating contaminated soil had been removed from the site during the Fuel Processing Facility Upgrade Project, the site was recommended for no further action, contingent on the evaluation of the contaminated backfill as part of the OU 3-13 RI/FS.

2.2.6 Site CPP-26

Site CPP-26 (see Figure 1-2) consists of soil that was potentially contaminated by a release of radioactive steam through a faulty hose coupling on a decontamination header. The release occurred in 1964. During the flushing process, the facility operator discontinued flushing after steam was observed leaking to the atmosphere from a hose coupling. The weather conditions at the time of the release included high winds, which resulted in a cloud of steam contaminating an estimated 13 acres to the northeast of the release location. Ten of the acres were outside the INTEC fence present at that time. Currently, only about 1 acre of the original 13 is now outside the facility fence.

Following the release, a sample of mud was collected near the decontamination header. It was found to contain 520 pCi/g of Cs-137, 3.3 pCi/g of Cs-134, 22,400 pCi/g of Ce-144, 3,600 pCi/g of Ru-106, 810 pCi/g of Ru-103, and 0.03 pCi/g of Pu-242. Reportedly, the liquid present near the header was cleaned up, solidified, and sent to the Radioactive Waste Management Complex (RWMC) for disposal. A surface radiation survey following the incident in 1964 detected between 2 and 10 mR/hour in the soil with one area having gross radiation as high as 200 mR/hour.

The CPP-26 site has been disturbed extensively since the release. A portion of the release site nearest to the decontamination header was excavated during the construction of Buildings CPP-699, CPP-654, and CSSFs 4, 5, and 6. A portion of the site has been covered by the construction of Hemlock Street. Any remaining contamination from the release that is within the current Tank Farm boundaries has been covered with 0.6 m (2 ft) of soil, a 20-mil thick membrane, and an additional 15 cm (6 in.) of soil to prevent the membrane from blowing away. Therefore, the contamination from the steam release would be expected to be approximately 0.8 m (2.5 ft) bgs in the Tank Farm area.

A surface radiation survey of the area was performed in 1991. Elevated gamma/beta radiation was not detected on the surface of the soil outside the Tank Farm that had not been disturbed since the steam release incident. Site CPP-26 was characterized as part of the OU 3-07 Track 2 investigation in 1992 (WINCO 1993a). Using a stainless steel hand auger, three borings were made in the alluvium near the location of the steam release to determine the nature and extent of residual contamination. These three borings were located to the east and northeast of Building CPP-635. Two borings were advanced to approximately 6 ft below the liner in the Tank Farm. The third boring was abandoned at 4 ft below the liner because of the presence of concrete. A total of nine soil samples, including three duplicate samples, wascollected from the three borings. The collected samples were analyzed for VOCs, selected metals, fluoride, nitrate, nitrite, pH, and radionuclides. The selection of the appropriate depths in each boring for collecting the soil samples was based on the highest measured radiation reading on soil collected as the boring was advanced.

During the Track 2 investigation, the radionuclides detected in the soil at the highest activities were Sr-90, Cs-137, and Eu-154. Lower levels of Pu-238, Pu-239, and Am-241 were also detected in the soil samples. The Cs-137 activities ranged from 108 ± 9.08 pCi/g to 6460 ± 465 pCi/g. These activities are much higher than would be expected as a result of the steam release, assuming that the Cs-137 activity (520 pCi/g detected in the mud sample collected at the site immediately following the release) is representative of the contaminant concentration in the soil. Almost half of the Cs-137 at the site would have decayed away in the 28 years since the release. The 1992 activities of less than 520 pCi/g in the soil would be more consistent with known information about the release. In addition, the nature of the release would have resulted primarily in surface soil contamination. The 1964 Tank Farm ground surface is now 0.8 m (2.5 ft) bgs. It is at these depths that the highest levels of contamination associated with the steam release would be expected, though in the Track 2 investigation the highest levels of radioactive contamination were found at approximately 1.22 m (4 ft) bgs. It is possible that the upper 2 ft of soil was removed following the incident, or contaminated soil was covered with clean soil; however, no documentation exists to support this conclusion. It is uncertain whether the contamination detected during the Track 2 characterization is a result of the steam release.

2.2.7 Site CPP-27 and CPP-33

Sites CPP-27 and CPP-33 consist of soil contaminated by a subsurface release of high-level liquid waste from the Tank Farm transfer system near the northeast corner of Building CPP-604. The release designated as CPP-27 was first discovered in 1974. The release, resulting in contaminated soil, was apparently from a badly corroded 2.1 to 2.4 m (7 to 8 ft) section of a pressure relief vent line located 3.7 m (12 ft) bgs. It was estimated that less than 100 gal of high-level waste and between 100 to 300 gal of low-level radioactive waste, containing approximately 1,000 to 3,000 Ci of radioactivity, was released. The source of the waste in the vent lines was either the 300,000-gal tanks storing high-level liquid waste or Tank WL-102, one of the feed tanks for the PEW Evaporator. It was suspected that the line had been leaking since about 1961. Radiation readings in the soil were reportedly as high as 25 R/hr.

The contaminated soil was excavated and boxed for disposal. The contamination spread laterally as far as 6.1 m (20 ft) and vertically to a depth of 8.5 m (28 ft) bgs. Approximately 275 yd^3 was removed from the site. Analysis of samples collected from the site in 1974 indicated that Cs-137, Sr-90, Cs-134, Eu-154, Sb-125, Ru-125, and Pu-239/240 contaminated the soil. Cesium-137 activities in the four samples were collected over almost a 3-month period and ranged from 2.89E ± 4 pCi/g to 3.03E ± 6 pCi/g. Strontium-90 activities in three samples ranged from 9.45E ± 4 to 8.59E ± 4 pCi/g and

Pu-239/240 activities in two samples were 4.59E ± 2 pCi/g to 2.97E ± 3 pCi/g. Only 25 mCi of radioactivity was estimated to remain at the site after removal of the contaminated soil.

However, in 1983, additional contaminated soil attributed to the corroded line was encountered in the same general area while excavating soil to replace Tank WL-102. This contamination is thought to be the result of a separate release from the same transfer line. It was designated as CPP-33 under the FFA/CO (DOE-ID 1991). Approximately 14,000 yd^3 of soil was removed from the site in 1983. Most of this soil (about 12,000 yd^3), which was not highly contaminated (less than 30 mR/hour), was disposed of in trenches in the northeast corner of the INTEC. The excavated area was backfilled and a portion covered by an asphalt road. Reportedly, residual contamination remained below and adjacent to the excavated and backfilled area.

In 1987, 10 borings were drilled to the top of basalt in the CPP-27/33 area to determine the extent of contamination. Direct radiation readings were taken in the borings using field instruments. No samples were collected from the borings for laboratory analysis. Information on the total depth of each boring is also unavailable. Beta/gamma radiation readings in the borings ranged from none detected to 50,000 counts per minute (cpm). In 1990, a deep boring was made in the area; 16 soil samples were collected from the alluvium above the basalt, and two soil samples were collected from the 33.5-m (110-ft) interbed. The samples were analyzed for a full suite of constituents including VOCs, SVOCs, metals, dioxins and furans, cyanide, and radionuclides. No contaminants were detected in the interbed. Cs-137 and Sr-90 were the primary contaminants detected in the alluvium. The highest activities were found between 2.1 m (7 ft) and 8.8 m (29 ft) bgs. The maximum activities detected were 608 ± 3 pCi/g and 328 ± 1.8 pCi/g, respectively, for Cs-137 and Sr-90.

Sites CPP-27 and CPP-33 also were characterized as part of the OU 3-08 Track 2 investigation in 1992 (WINCO 1993a). Three borings were drilled at the site. One was drilled to 14 m (46 ft) bgs and two were drilled to 3.7 m (12 ft) bgs. Twenty soil samples were collected and analyzed for VOCs, metals, selected anions, pH, and radionuclides. The selection of the appropriate depths in each boring from which to collect the soil samples was based on the highest measured radiation reading on soil collected as the boring was advanced. Sixteen of 20 samples analyzed by gamma spectroscopy had Cs-137 activities above expected background levels. Elevated levels of Cs-137 were measured in borehole CPP-27-1 at depths from 0.6 to 6.9 m (2 to 22.5 ft) bgs; in borehole CPP-27-2 at depths from 1.2 to 3 m (4 to 10 ft) bgs; and in borehole CPP-27-3 at depths from 1.2 to 1.8 m (4 to 6 ft) bgs. Slightly elevated alpha activities were found in boreholes CPP-27-1 and CPP-27-3 at depths from 1.8 to 4.9 m (6 to 16 ft) bgs and 1.2 to 3.6 m (4 to 12 ft) bgs, respectively, in the two boreholes.

2.2.8 Site CPP-28

Site CPP-28 is contaminated soil, associated with a subsurface release of high-level liquid waste from a breached transfer line. The line was used to carry radioactive first-cycle extraction waste solutions from the uranium recovery process to the Tank Farm. The breach, a 0.4-cm-diameter (1/8-in.) hole drilled in the transfer line (PWA-1005), was discovered in 1974 during installation of a cathodic protection electrode. It is suspected that the line was breached during installation in 1955. Though the 7.6-cm (3-in.) stainless steel transfer line was enclosed in pipe encasement, deterioration of the encasements allowed liquid to be released through the joints to surrounding soil. Contaminated soil, encountered 1.8 m (6 ft) bgs in 1974, reportedly had radiation readings up to 40 R/hr. It was estimated that 454 L (120 gal) of high-level liquid waste containing 6,000 Ci of radioactivity was released between 1955 and 1974. A revised estimate in the OU 3-13 RI (DOE-ID1997) is 13,636 L (3,600 gal) versus the original estimate of 454 L (119.9 gal), containing approximately 29,000 Ci of radioactivity.

Following discovery of the contaminated soil, six soil borings were drilled in the area in 1974, and a soil sample was collected from the bottom of each boring. The samples were collected from depths that ranged from 2 m (6.5 ft) bgs to 3 m (10 ft) bgs. The samples were screened in the field for radioactivity. The highest activity (40 R/hr) was detected in a sample collected from a depth of 2 m (6.5 ft) bgs. The area around the transfer line was excavated and approximately 56 yd^3 of contaminated soil were removed. No contaminated soil below the pipe encasement [approximately 2 m (6.5 ft) bgs] was removed because of the high radiation levels. It was estimated that approximately 4.7 yd^3 of highly contaminated soil were left in place, and the excavation was backfilled. Eleven cased boreholes were installed in the backfilled excavation to measure the radiation levels in the soil. Radiation readings in each of the wells were measured to a depth of 3.7 m (12 ft) bgs. Significant subsurface radiation was detected in four of the wells and indicated that the contamination extended to a depth of approximately 2.7 m (9 ft) bgs. The vertical extent of contamination at the site was estimated to be 2.7 m (9 ft) in diameter. The wells were supposedly cut off below grade and abandoned.

During the 1993 to 1996 Tank Farm upgrades, a portion of site CPP-28, and portions of sites CPP-25,.CPP-20, and CPP-79 were excavated. Excavation depths ranged from 0-11 m (0-35 ft) bgs, including the berm height, with most excavation depths at about 4.6 m (15 ft) bgs. Field gamma/beta radiation measurements encountered during excavation ranged from 0 to 5 R/hour.

An attempt was made to locate and excavate the 1974 observation wells during the OU 3-07 Track 2 investigation in 1992. The investigation failed to locate the wells, and whether the wells are still present at the site or have been removed is unknown. The 1992 soil activities of radionuclides, known to be present in the released waste were calculated, based on the average percent distribution of the radionuclides in the waste, and the total soil activity was calculated, based on 3,000 Ci present in 4.7 yd^3 of soil.

Information gained during characterization of other sites within the Tank Farm led investigators to believe that the depth and extent of contamination at CPP-28 have been underestimated. Soil in Boring 79-1, which is located approximately 9.1 m (30 ft) southeast of the location of the transfer line leak, was contaminated at a depth of 9.1 (30 ft) bgs. The extremely high concentrations of radionuclides found in Boring 79-1 strongly suggest that the contamination is related to a leak of high-level liquid waste. Based on this and the proximity of the boring to the transfer line leak, the original (1974) estimates of the quantity of waste released to the soil at CPP-28 are thought to be low.

The existing data suggest that contamination at CPP-28 extends from 2 m (6.5 ft) bgs to the soil basalt interface at 12.8 m (42 ft) bgs and south of the original release site because tank WM-181 is immediately north of the site. The lateral extent of contamination is not well defined.

2.2.9 Site CPP-30

Site CPP-30 is an area of radioactively contaminated soil near Tank Farm Valve Box B-9, discovered by maintenance personnel in 1975. The contamination covered an area of 400 ft^2 and produced radiation levels of up to 1 R/hour. The contamination resulted from a one-time maintenance event in which residual decontamination solution from the floor of the valve box contaminated worker clothing and equipment. The clothing and equipment were brought to the surface and placed on blotter paper covering the ground surface. The contamination spread to the soil, either through handling or tears in the blotter paper. This site was recommended in a Track 2 as a no further action site because the entire area has been excavated in the past. The contaminated soil was placed in four 55-gal drums and shipped to the RWMC. CPP-30 is being revisited in OU 3-14 RI/FS as part of the Tank Farm soil investigation.

2.2.10 Site CPP-31

Contamination at site CPP-31 was discovered in 1975 during drilling for a monitoring well, A-53, at a location approximately 15 ft west of tank WM-183, and 10 ft south of the edge of the tank vault. Beta/gamma radiation levels in the soil brought to the surface by auger drilling, reportedly ranged from 100 R/hr at 4.6 m (15 ft) bgs to 500 R/hr at 6.3 m (22 ft) bgs. The apparent cause of contamination was determined to be the failure of a carbon steel line (WRN-1037) located approximately 1.5 m (5 ft) bgs. Waste had entered the line, though it was not in use, through a normally closed valve (WRV-147) during transfer from tank WM-181 to tank WM-180 in November 1972. The second- and third-cycle waste caused the carbon steel line to corrode and fail. An estimated 14,000 gal of waste was released, contaminating approximately 600 to 800 yd^3 of soil. The waste was calculated to contain 28,000 Ci of fission products, primarily Cs-137, Sr-90, and Y-90.

Following the discovery of the release, the carbon steel line was cut at the valve and capped to prevent any further waste from entering the line. Additional drilling was done to delineate the extent of contamination in the subsurface wells, designated as A53 through A53-31 and A-55 were installed in the area. Direct radiation readings were obtained in the wells by lowering a string of thermoluminescent dosimeter (TLD) chips down the well and exposing them for a period of 1 hour. Readings taken in this manner from the 33 wells ranged from background levels to 50 R/hour. Based on the readings obtained, the zone of greatest contamination was estimated to be between 6 and 9 m (13 to 20 ft) bgs. Seven wells had readings of 10 R/hour or greater at one or more points between 9 and 6 m (13 to 20 ft) bgs. In the general vicinity of Valve Box A-6, high radiation fields (up to 4 R/hour) were measured at depths of 0.6 to 3 m (2 to 10 ft) bgs.

In the early 1980s, several additional wells, designated the 81-series, were installed in the Tank Farm area. As part of the 1992 OU 3-07 Track 2 investigation, radiation readings were collected from 10 of the A53 and 81 series wells. Readings ranged from background levels to 22,300mR. The results of initial and Track 2 investigation do not fully delineate the vertical or lateral extent of contamination at the site. However, the available information indicates that most of the soil contamination is concentrated between 3 to 7.6 m (10 to 25 ft) bgs in the area of high-level liquid waste transfer line PWA-1005 with a shallower source of contamination present near Valve Box A-6.

2.2.11 Site CPP-32 (E and W)

Sites CPP-32E and 32W are two areas of localized contamination near Valve Box B-4. The contamination at CPP-32E appears to be the result of condensation of contaminated water vapor in the valve box that was released on the ground surface through an air vent tube and view port pipe that extended out of the valve box. Site CPP-32W is approximately 15 m (50 ft) northwest of Valve Box B-4 and is suspected of being the result of a leak in an aboveground pipe used to pump water from tank sumps to the PEW evaporator. Both of these surface releases have since been covered with 0.76 m (2.5 ft) of soil and the Tank Farm membrane.

Both sites were identified in December 1976, and were described as having surface radiation contamination up to 2 R/hour and up to 31 cm (12 in.) deep. Site CPP-32E was estimated to cover an area about 8 ft^2 and CPP-32W an area of about 6 ft^2. It is unknown whether any cleanup of the sites occurred after they were identified in 1976. The Tank Farm membrane was installed in 1977. During the OU 3-07 Track 2 investigation in 1992, a soil boring was drilled adjacent to the vent tube to 1.5 m (5 ft) below the Tank Farm membrane, where the concrete valve box was encountered. During field screening, the highest beta/gamma radiation reading, 900 cpm above background, was detected between 0.43 and 0.88 m (1.4 and 2.9 ft) below the membrane, which is approximately 0.76 m (2.5 ft) below the current ground surface. This depth is roughly equivalent to the ground surface at the time of the release.

Samples were collected from 0.43 and 0.88 m (1.4 and 2.9 ft) below the membrane and 0.67 to 0.88 m (2.2 to 2.9 ft) below the membrane. The samples were analyzed for VOCs, mercury, cadmium, gamma-emitting radionuclides, gross alpha and gross beta radiation, and Sr-90. Cesium-137 activities ranged from 133 pCi/g to 277 pCi/g. Europium-154 activities ranged from 0.456 pCi/g to 0.811 pCi/g and Sr-90 activities ranged from 153 pCi/g to 278 pCi/g. No field investigation of CPP-32W was carried out during the Track 2 because the exact location of the site was no longer known. It was recommended for further characterization during the WAG 3 comprehensive RI/FS.

2.2.12 Site CPP-58 (E and W)

Site CPP-58 is composed of two areas of soil contamination associated with the PEW evaporator. Site CPP-58E is soil contamination resulting from a subsurface release of PEW condensate in 1976. The PEW evaporator was used to concentrate all dilute low- and intermediate-level radioactive liquid waste. The concentrated "bottoms" solution from the PEW evaporator was sent to the Tank Farm as incidental liquid waste and the "overhead" condensate was sent to the Service Waste System. An estimated 75,700 L (20,000 gal) of condensate was released when a transfer line failed between the PEW evaporator and the Service Waste Diversion System in Building CPP-751. The release occurred where the pipe makes a 90-degree turn and the diameter of the line narrows from 8 to 5 cm (3 to 2 in). The line is buried 1.8 m (6 ft) bgs. An estimated 51 mCi of tritium, 2 mCi of Sr-90, 4 mCi of Ru-106, 2 mCi of Cs-137, and 1 mCi of Ce-144 were released. Though the damaged line was repaired, it is believed that contaminated soil was left in place and covered with clean soil.

Site CPP-58W consists of soil affected by a release of PEW condensate in 1954. The condensate leaked from a transfer line buried 1.8 to 2.4 m (6 to 8 ft) bgs between buildings CPP-604 and CPP-601. No information is available about how often the transfer line was used, how long the pipe leaked, or the quantity of condensate released. Since the time of the release, building CPP-649 was constructed on top of the area where the spill occurred. If the contaminated soil was not removed during excavation for the building footers, it is probably contained below the building.

As part of the 1992 Track 2 Investigation for OU 3-11 (WINCO 1993c), two borings were made at the CPP-58E site. One, drilled to a depth of 3.6 m (12 ft) bgs, was located approximately 9.1 m (30 ft) southwest of the release. The other was drilled to a total depth of 14 m (46 ft) bgs and was located within 3.6 m (12 ft) of the release site. It was planned that samples for laboratory analysis would be collected from intervals exhibiting the highest gamma/beta radiation readings as measured with field instruments. However, because no radiation above background was detected in either boring, samples that were representative of the entire drilled intervals were collected. Nine samples were collected from the two borings and analyzed for VOCs, mercury, cadmium, fluoride, nitrate, nitrite, pH, and radionuclides.

Results of the sampling and analysis indicate that Cs-137 activities ranged from 0.269 ± 0.0211 pCi/g to 63.1 ± 4.57 pCi/g, and Sr-90 activities ranged from 0.877 ± 0.276 pCi/g to 33.4 ± 3.17 pCi/g. These contaminants are consistent with the wastestream reported as released at the site. Cesium-137 concentrations are generally higher than Sr-90 concentrations above 6.7 m (22 ft) in Boring CPP-58E-1 and in Boring CPP-58E-2. The Sr-90 activities are higher than the Cs-137 activities below 6.7 m (22 ft) in Boring CPP-58E-1, possibly as a result of the greater mobility of Sr-90 relative to Cs-137. The contaminated zone for this site is estimated as being present from 1.8 to 14.0 m (6 to 46 ft) bgs.

2.2.13 Site CPP-79

During transfers in July and August 1986, 9,463 L (2,500 gal) of liquid waste was released to the soil south of Tank WM-181. This waste contained low levels of radioactivity, heavy metals, and traces of organic compounds. The release was apparently a result of condensate backing up in the transfer line and into an open drain line from and into Valve Box A-2. The condensate leaked out of the valve box and through the split tile encasement around the transfer line exiting the valve box. The transfer line and valve box are buried at a depth of approximately 3 m (10 ft). It is believed that part of the contaminated soil at this site was removed during the 1994 Tank Farm Upgrade Project.

As part of the OU 3-07 Track 2 Investigation in 1992, one soil boring was drilled near the release site. The borehole location was on a berm approximately 2.4 m (8 ft) above the land surface in the Tank Farm. Seven samples were selected for laboratory analysis based on field radiation readings. Samples were collected from the following intervals: 1.8 to 2.4 m (6 to 8 ft) bgs, 4.3 to 4.9 m (14 to 16 ft) bgs, 7.3 to 8.5 m (24 to 28 ft) bgs, and 9.8 to 9.9 m (32 to 32.5 ft) bgs.[a] A very sharp increase in the levels of beta/gamma radiation was detected at 9.5 m (31 ft) bgs. The sample taken from 9.8 to 10.4 m (32 to 34 ft) bgs had surface beta/gamma radiation readings of 400 R/hr. One sample was collected from this interval for radionuclide analysis.

Samples collected above 8.5 m (28 ft) had relatively low activities of radionuclides, consistent with a release of low-level condensate. The highest gross alpha, beta, and Cs-137 activities were from the sample collected from 4.3 to 4.9 m (14 to 16 ft) bgs. The Cs-137 concentration in this sample was 20.9 ± 1.5 pCi/g, and the Sr-90 activity was 54.4 ± 3.46 pCi/g. The gross beta and Cs-137 activities remained above background levels from 4.3 to 6.7 m (14 to 22 ft) bgs. But samples collected from 7.3 to 8.5 m (24 to 28 ft) bgs contained radionuclides near or below background levels suggesting that contamination associated with the leak of condensate had not migrated below 7.3 m (24 ft) bgs.

The radionuclide analysis of the sample collected from 9.8 to 9.9 m (32 to 32.5 ft) bgs measured significantly higher gross alpha (8.09E5 ± 9.71E4 pCi/g) and beta (1.89E7 ± 1.52E6 pCi/g) activities than were measured in sample intervals above 7.3 m (24 ft) bgs. Isotopic analysis of this soil also detected significantly higher concentrations of Cs-137 (3.37E7 ± 1.06E6 pCi/g), Sr-90 (5.41E6 ± 4.91E3 pCi/g), and Am-241 (1.66E4 ± 2.18E3 pCi/g) activities than in shallower intervals. This has led investigators to conclude that the deeper contamination is not from the reported condensate spill associated with Site CPP-79.

The extremely high concentrations of radionuclides found in Boring 79-1 strongly suggest that the contamination is related to a leak of high-level liquid waste. The boring is located approximately 9.1 m (30 ft) southeast of the location of a transfer line leak (see discussion on site CPP-28, Section 2.2.8). Hence the source of the deep contamination detected in 79-1 is thought to be a transfer line leak associated with CPP-28. The data suggest that contamination at CPP-28 extends from 2 m (6.5 ft) bgs to the soil basalt interface at 12.8 m (42 ft) bgs and south of the original release site because tank WM-181 is immediately north of the site. The lateral extent of contamination is not well defined.

3. FIELD SAMPLING PLAN OBJECTIVES

This FSP focuses on obtaining data that will address issues pertaining to Tank Farm soil contamination, and is based on findings documented in the OU 3-13 RI/FS report. These guiding documents specify the need to assess the potential for groundwater contamination originating from contaminated soil within the Tank Farm fence. This FSP requires three distinct data collection and analysis efforts:

- **Soil contamination:** Identify soil contaminants and assess their concentration and distribution within the Tank Farm soil investigation area (Phase I).

- **Contaminant transport:** Assess the potential for Tank Farm soil contaminants to migrate into groundwater by a study of Tank Farm soil and groundwater transport properties (Phase II).

- **Risk assessment:** Perform contaminant transport modeling based on best estimates of contaminant distribution and transport parameters to assess the Tank Farm soil contribution to aquifer contamination (Phase II).

This FSP addresses data needs developed using the U.S. EPA Data Quality Objective (DQO) process. The Principal Study Questions (PSQs) pursuant to OU 3-14 Tank Farm Soil DQOs are listed in Table 3-1. The PSQs are based on the DQOs, which are found in Appendix D. Two separate field activity phases are planned to fully address the PSQs. Phase I activities, as outlined in this FSP, will provide information on the overall distribution of radioactive contamination within the Tank Farm Soil. These data will serve to focus Phase II sampling activities toward specific areas of interest. Phase II activities, which will address detailed questions concerning the identity, concentration, and transport characteristics of specific analytes of concern, will be fully described in a new FSP to be developed after completion of the Phase I field program. The two-phase approach is proposed as a means for focusing project resources on the specific contaminated soil areas that are expected to contribute to groundwater contamination or that could affect selection of a remedy for the Tank Farm.

3.1 Data Needs

Specific data needs for Phase I sampling activities were developed, based on consideration of relevant Table 3-1 PSQs. Phase I sampling will focus on detecting and mapping the three-dimensional distribution of gamma-ray-emitting radionuclides within the Tank Farm soil. Gamma-ray detectors will be employed to map surface and subsurface radiation fields. Cesium-137 soil contamination is expected to be the principal source of the mapped radiation fields. Cesium-137 has been found in all contamination zones discovered in the Tank Farm to date, and it is a universal constituent of processed wastestreams in past and present Tank Farm operations, and it is easily detected at low concentrations (<10 pCi/g). Anomalous gamma-radiation areas, most likely associated with Cs-137 contamination, will then serve as an indicator of contamination zones where other analytes of concern are most likely to occur. These areas will become the focus for future (Phase II) field activities to identify and fully characterize addition analytes of concern, their nature and extent, their mobility, and the moisture/contaminant flux.

Table 3-1. Principal study questions relevant to Tank Farm Soil data needs and extent to which these needs are addressed by Phase I and Phase II FSPs.

Principal Study Question	Phase I FSP	Phase II FSP	OU 3-14 Objective
1a. What is the number and spatial extent of contamination zones in the 0 to 10 ft depth range?	Yes	No	Surface exposure
1b. What is the number and spatial extent of high contamination zones in the 0 to 45 ft depth range?	Yes	No	Aquifer contamination
2a. What are the radionuclide contaminants in each of the high contamination zones?	Yes	Yes	Soil from vacuum excavation and process knowledge
2b. What are the nonradionuclide contaminants in each of the high contamination zones?	Yes	Yes	Soil from vacuum excavation and process knowledge
3. What is the extent of the mobility of each of the contaminants within each of the identified soil matrices?	No	Yes	Aquifer contamination
4a. What is the vertical moisture flux moving from the Tank Farm soil into the basalt?	No	Yes	Aquifer contamination
4b. What is the horizontal moisture flux into or out of the Tank Farm Soil?	No	Yes	Aquifer contamination

3.2 Sampling Methods

Soil contaminant distribution within the Tank Farm soil will be investigated, using a combination of in situ radiation measurement methods and soil sampling. In situ radiation measurements will be performed areally over the open ground surface and vertically in sealed steel casing driven into the Tank Farm subsurface by direct push methods. Casings will be installed on a modified grid pattern distributed across the entire Tank Farm soil area of interest. Downhole radiation logging measurements will be performed within these casings from ground surface to total depth. Surface and downhole in situ radiation measurements will be used to detect gamma-ray emitters. It is anticipated that Cs-137 will be the predominant gamma-ray emitter and will serve as an indicator to direct future detailed sampling for additional analytes of concern in specific areas of interest. The planned logging system will not have sufficient gamma-ray energy resolution for detailed radionuclide speciation. While gamma-radiation hot spots can be detected, the causative radionuclides cannot be determined. The 662 keV gamma ray emitted by Cs-137 is detectable through steel casing to levels below 10 pCi/g. Downhole radiation logging of the probes from the surface to 15 ft bgs will be performed for the first couple of probeholes. The results will be examined to determine if the information is representative of the soil contamination at that location. Evidence that the logging results are invalid due to the soil vacuuming, backfill soil around the casing, or other reasons affecting the top 15 ft will result in discounting the 0 to 15 ft bgs logging of the remaining probeholes.

A vacuum excavator system will be employed to create pilot holes for casing installation. Pilot holes will extend from ground surface to approximately 4.5 m (15 ft) bgs to safely penetrate through soil and avoid Tank Farm piping or other obstructions associated with past and present Tank Farm operations.

Prior to any excavation, the proposed locations will be surveyed, staked, and preapproved by management, and verified, based on drawings and historical documentation. Soil removed during vacuum excavation will be vacuumed in 5-ft increments and stored in lined drums (anticipated to be 35- or 55-gal drums). The material will be screened for radiological contamination with a hand-held beta/gamma detector. This material will also be selectively sampled for laboratory radionuclide and metals analysis at INTEC to verify the presence or absence of contamination in the surface exposure pathway. As feasible, the vacuumed material not needed for samples will be returned to the annulus between the casing and the probehole wall in the 5-ft lifts and in the same order in which it was taken out. If the removed material is above 5 mrem/hr, other appropriate backfill material will be used. Other material would include a lower hydraulic gradient material such as sand or bentonite chips. The remaining soil will be drummed and stored as investigation-derived waste (IDW) by the INTEC environmental coordinator or WAG personnel assigned to the project.

Vacuum extraction will alter the soil media characteristics within the immediate vicinity of the probehole. This upper disturbed zone will affect logging measurements whether it is left open or backfilled with clean soil. This upper disturbed zone may be logged, if it is determined that useable data is being collected. It is understood, because of the influence of the disturbed zone surrounding the probe, that these measurements cannot be directly compared against sample results of logging from deeper undisturbed intervals. Their primary utility will be to detect the presence of elevated contamination levels in the upper 4.5 m (15 ft) of soil.

The logging tool has a finite depth of investigation due to the fact that gamma-rays are attenuated by the soils media and casing surrounding the probehole. For Cs-137, the depth of investigation is on th order of 1 foot from the center of the logging detector. This limitation is a significant problem primarily when the radionuclide distribution is highly discontinuous, since abrupt changes in concentration would not be detected if they occur just beyond the investigation zone. At the Tank Farm, it is reasonable to assume tat radionuclides exist as broad soil plumes with concentrations that vary smoothly from a central hot spot to a background fringe. In this case, distributions may be accurately imterpolated between probeholes. However, the exact location of the hot spot and fringe will be subject to uncertainty proprotional to the probe spacing.

Low energy gamma-rays, e.g. from Am-241 or u-239, will be greatly attenuated by the probe casing. Thus, the presence of low energy gamma emitters will generally not be recognized unless they are co-located with higher energy gamma emitters such as Cs-137. Historical records for INTEC suggest that Cs-137 was universally present in Tank Farm waste streams, which accounts for its utility as an indicator contaminant. Differential movement of radionuclides by fluid and/or vapor transport could cause some separation of constituents that cannot be distinguished by Phase I logging.

Beta emitters such as Sr-90 cannot be detected by the radiation logging system and can only be evaluated based on historical information concerning the original waste streams. Sr-90 evaluation will be particularly difficult due to its solubility and tendency to move in the subsurface relative to Cs-137.

3.3 Quality Assurance Objectives for Measurements

The QA objectives for laboratory analytical measurement will meet or surpass the minimum requirements for data quality indicators that are established in the QAPjP (DOE-ID 2000b). This reference provides minimum requirements for the following measurement quality indicators: precision, accuracy, representativeness, completeness, and comparability (PARCC). Precision, accuracy, and completeness will be calculated in accordance with the QAPjP. In addition to the QAPjP, INEEL Environmental Restoration QA requirements are also contained in the INEEL Implementing Project Management Plan (LMITCO 1998a).

The procedures to support QA objectives for field screening measurements are in the process of being written. Currently, QA objectives are met by daily repetition logging. Gamma measurements are taken with the borehole probe instrument, then the process is repeated at the end of the day. If the data at the end of the day are different from the first readings, the assumption is made that the data are not valid.

3.3.1 Precision

Precision is a measure of the reproducibility of measurements under a given set of conditions. In the field, sample collection procedures and the natural heterogeneity in the soil affect precision. Overall precision (field and laboratory) can be evaluated by the use of duplicate samples collected in the field.

Laboratory precision will be based on the use of laboratory-generated duplicate samples or matrix spike/matrix spike duplicate samples. Evaluation of laboratory precision will be performed during the method data validation process.

Field precision will be based on analysis of co-located field duplicate or split samples. A field duplicate will be collected at a minimum frequency of 1/20 environmental samples for those samples that are collected for laboratory analyses.

3.3.2 Accuracy

Accuracy is a measure of bias in a measurement system. Laboratory accuracy is demonstrated using laboratory control samples, blind quality control (QC) samples, a performance evaluation sample, and matrix spikes. Evaluation of laboratory accuracy will be performed during the method data validation process. Accuracy is affected by overall sample preservation and handling, field contamination, and the sample matrix in the field. The effects of the first three can be assessed by evaluation of the results of equipment rinsates. Field accuracy will be determined for samples collected for laboratory analysis.

3.3.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which the sampling and analysis data reflect the characteristics being measured. The representativeness of this sampling event is based on the number of samples collected and the sample location. The sample locations and number of samples collected are determined, based on the history of known releases in the Tank Farm, past sampling events, and underground hazards. The sampling locations are biased in two ways. Some probehole locations are biased toward known areas of contamination to better define the extent of contamination in these areas. In other cases, the presence of above ground and/or subsurface obstructions prevents the location of probeholes in these areas. Thus, the probeholes are biased away from these areas with above ground or subsurface obstructions.

3.3.4 Completeness

Completeness is a measure of the quantity of usable data collected during an investigation. Factors such as equipment and instrument malfunctions, and insufficient sample recovery affect field sampling and field measurement completeness. The QAPjP requires an overall completeness goal of 90% for noncritical samples and 100% for critical samples (DOE-ID 2000b).

The completeness goal for the Tank Farm characterization is 90% for noncritical samples and 100% for critical samples. If the 90% completeness goal for noncritical samples is not achieved during Phase I, then this will be identified as a data gap and evaluated during the scheduled Phase II investigation. Critical data points are sample locations for which valid data must be obtained in order for the sampling event to be considered complete. For this project, critical data points are defined as those sample locations that have the ability to define the upper limits of contamination that will be addressed during the feasibility study. If many sample locations are identified for a given release site (e.g., CPP-31), then the sample locations providing representative coverage are identified as critical. As such, the following sample locations will be considered critical for the Phase I investigation:

A1-02 or A1-03	B1-02	Cl-01	D1-01
A1-04		C1-02	D1-02
Al-07 or A1-08	B1-04	C1-05	D1-03
A1-09	B1-07	C1-06	D1-04
A1-10 or A1-11	B1-08	C1-07	D1-05
A1-13	B1-09		D1-06
Al-15			

Sampling inside the Tank Farm presents unique constraints on the actual sample collection, sample handling, and the physical location of obstructions. The primary constraint on the OU 3-14 sampling activities is the presence of high-level waste transfer lines and the inherent safety hazards associated with working in the Tank Farm (e.g., worker exposure). If data cannot be obtained from the locations determined as critical, then the Agencies will be notified and an alternate sample location may be identified. If an acceptable alternate location is not identified or cannot be sampled, all uncollected samples from critical locations will be carried forward and addressed during the Phase II characterization activities.

3.3.5 Comparability

Comparability is a qualitative characteristic that refers to the confidence with which one data set can be compared to another. Comparable data must be obtained using unbiased sample designs. If sampling designs are biased, the reasons for selecting another design will be well documented.

3.3.6 Sample Prioritization

Because of the nature of sampling inside the Tank Farm, a sample prioritization strategy must be used to guide field personnel through the sample collection process. A prioritized sample strategy was designed to meet the objectives of the OU 3-14 Work Plan. The solid samples will be collected from the upper 4.5 m (15 ft) of alluvial fill.

The priority for the sampling and analysis is summarized in Table 3-2. Samples with the highest priority are labeled 1, intermediate are labeled 2, and lowest priority are labeled 3.

Table 3-2. Prioritized sample collection strategy for Phase I.

	Priority	
Analysis Category	"clean"	"hot"
CLP constituents	N/A	2
Radiological constituents	1	1
Gamma total activity	1	1

3.4 Data Validation

Method data validation is the process whereby analytical data are reviewed against set criteria to assure that the results conform to the requirements of the analytical method and any other specified requirements.

A formal technical review process will validate in situ measurement data.

Laboratory-generated data from the sampling and analysis of pilot-hole soil will be validated to Level A, as described in INEEL technical procedure (TPR)-79, "Levels of Analytical Method Data Validation." Level A validation is the most stringent validation level requiring review of all laboratory QA/QC data, as well as raw data generated as the result of the analytical process. All other laboratory generated analytical data will be reviewed for analytical method compliance and technical merit.

3.5 Quality Assurance/Quality Control Samples

The probeholes that make up the grid (85 probeholes) will be grouped based on the gross count gamma readings into an activity level distribution. This distribution will be used to select 20% of the probeholes from which drummed vacuumed soil will be sampled for stable metal analysis.

Collection of QA/QC samples obtained during the Tank Farm sampling effort will be performed to satisfy the QA requirements for field operations as per the QAPjP. Table 3-3 lists the minimum field QC samples to be collected during Phase I Tank Farm sampling.

Laboratory QA/QC samples will be analyzed per the FSP as required by the SMO Master Task Agreement.

Table 3-3. Field quality control samples for Tank Farm characterization.

Sample Type	Collection
Duplicate	Duplicates will be collected at a minimum frequency of 1/20 environmental samples or 1 per day per sample matrix, whichever is less.
Field Blank	Field blanks are recommended only for subsurface soil collected for radionuclide analyses. Field blanks shall be collected at a minimum frequency of 1/20 environmental samples or 1 per day, whichever is less. The field blanks shall be analyzed for the same radiological constituents as the environmental samples.
Equipment Rinsate Blank	Equipment blanks shall be collected from the same equipment used to collect samples and shall be analyzed for the same constituents. Equipment blanks are not required when using dedicated or disposable equipment. The minimum frequency is 1/20 environmental samples or 1 per day, whichever is less.